Physics Year 11 – Autumn Term 2021

	Note: topics 7 and 9 are physics separate only	What? When? Why?			
	PHYSICS **P8 Energy, work and power P9 Forces and their effects**	**PHYSICS** **P6 Radioactivity**	**PHYSICS** **P12 Magnetism and p13 induction**	**PHYSICS** **P14 Particle Model**	**PHYSICS** **P10 Electricity and Circuits**
Lesson 1 Learning intentions	**Work & Power revising energy stores and transfers** Identify the different ways that the energy of a system can be stored eg thermal, kinetic, gravitational Identify the different ways that the energy of a system can be changed a) through work done by forces b) in electrical equipment c) in heating.	**The structure of the atom (may take more than one lesson if they can't recall it from chemistry)** What is inside atoms? What are the properties of subatomic particles? Recall the relative masses and relative electric charges of protons, neutrons, electrons and positrons Be able to do calculations of the numbers of protons, neutrons and electrons in an atom or ion Explain what an isotope is	**Introduction to magnetism (could be two lessons depending on practical time plotting fields)** Recall that unlike magnetic poles attract and like magnetic poles repel Describe the uses of permanent and temporary magnetic materials including cobalt, steel, iron and nickel Explain the difference between permanent and induced magnets Describe the use of plotting compasses to show the shape and direction of the field of a	**Introduction to particle theory** Use a simple kinetic theory model to explain the different states of matter (solids, liquids and gases) in terms of the movement and arrangement of particles Consider crushing can pract Describe that when substances melt, freeze, evaporate, boil, condense or sublimate mass is conserved and that these physical changes differ from some chemical changes because the material recovers its original properties if the change is reversed	**Electric circuits** Describe the structure of the atom, limited to the position, mass and charge of protons, neutrons and electrons Recall that in an atom the number of protons equals the number of electrons and is therefore neutral Draw and use electric circuit diagrams representing them with the conventions of positive and negative terminals, and the symbols that represent cells, including batteries, switches, voltmeters, ammeters, resistors, variable resistors, lamps, motors, diodes, thermistors, LDRs and LEDs

		Be able to recall the typical size (order of magnitude) of atoms and small molecules. Describe the structure of nuclei of isotopes using the terms atomic (proton) number and mass (nucleon) number and using symbols in the format ${}^{13}_{6}C$	magnet including the Earth's magnetic field Describe the shape and direction of the magnetic field around bar magnets and relate the strength of the field to the concentration of lines Explain how the behaviour of a magnetic compass is related to evidence that the core of the Earth must be magnetic Explain that magnetic forces are due to interactions between magnetic fields (eg the Earth's field and the compass's field)		Describe the differences between series and parallel circuits
Lesson 2 Learning intentions	**Kinetic energy calculations** Recall the equations used to calculate kinetic energy Kinetic energy = 0.5 x mass x $(speed)^2$ Identify the energy being transformed in complex examples including examples where objects change speed	**Development of atomic models** Describe how and why the atomic model has changed over time Include reference to the plum pudding model explaining what this model was like Describe Rutherford's alpha particle scattering	**Magnetic effect of a current (electromagnets)** Describe how to show that a current can create a magnetic effect and relate the shape and direction of the magnetic field around a long straight conductor to the direction of the current Recall that the strength of the field depends on the	**Density 1** Explain the differences in density between the different states of matter in terms of the arrangements of the atoms or molecules Recall and use the equation: density (kg/m^3) = mass (kg) ÷ volume (m^3) $\rho = m / V$	**Current & potential difference** Recall that a voltmeter is connected in parallel with a component to measure the potential difference (voltage), in volts, across it Recall that an ammeter is connected in series with a component to measure the

		experiment and why it replaced the plum pudding model. This lead to the Bohr model (like the chemistry diagrams with the electron shells)	size of the current and the distance from the long straight conductor Explain how inside a solenoid (an example of an electromagnet) the fields from individual coils add together to form a very strong almost uniform field along the centre of the solenoid but also cancel to give a weaker field outside the solenoid (this can easily be seen as a class practical with solenoids and iron filngs) Relate to earlier work (y8?) on electromagnets	Core Practical: Investigate the densities of solid and liquids. Start with liquids and regular solids	current, in amps, in the component Describe that when a closed circuit includes a source of potential difference there will be a current in the circuit Recall that current is conserved at a junction in a circuit
Lesson 3 Learning intentions	**Gravitational energy calculations** Recall the equations used to calculate gravitational energy GPE = mass x gravitational field strength x height Identify the energy being transformed in complex examples including	**Electrons & orbits** Recall that in each atom its electrons orbit the nucleus at different set distances from the nucleus. Explain that electrons change orbit when there is absorption or emission of electromagnetic radiation. Explain how atoms may form positive ions by losing outer electrons.	**Force on a current carrying conductor** **Recall that a current carrying conductor placed near a magnet experiences a force (and that an equal and opposite force acts on the magnet)** **Recall and use Fleming's left-hand rule to represent the relative directions of the force,**	**Density 2** Core Practical: Investigate the densities of solid and liquids. Do irregular solids and clarify calculations	**Current, charge and energy** Explain that potential difference (voltage) is the energy transferred per unit charge passed and hence that the volt is a joule per coulomb Recall and use the equation: energy transferred (joule, J) = charge moved (coulomb, C) × potential difference (volt, V) $E = Q \times V$

	examples where objects fall or are lifted		**the current and the magnetic field for cases where they are mutually perpendicular** **Demonstrate catapult field** **Make simple motors**		Explain that an electric current as the rate of flow of charge and the current in metals is a flow of electrons Recall and use the equation: charge (coulomb, C) = current (ampere, A) × time (second, s) $Q = I \times t$
Lesson 4 Learning intentions	**Work Done** Describe how to measure the work done by a force using the equation: work done = force x distance (moved in the direction of the force) $E = F \times d$ Illustrate this with the trainer practical or a similar friction based practical	**Types of radiation** Recall that alpha, β– (beta minus), β+ (positron), gamma rays and neutron radiation are emitted from unstable nuclei in a random process. Demonstrate Americium (alpha and weak gamma source) Know that an alpha particle is a high energy helium nucleus which is the biggest particle with a +2 charge Relate its size to the fact it was first to be found, is most ionising and lowest penetrating. Show the strontium 90 beta source.	**Calculations with magnetic forces** **Use the equation:** **force on a conductor at right angles to a magnetic field carrying a current (newton, N) = magnetic flux density (tesla, T or newton per ampere metre, N/A m) × current (ampere, A) × length (metre, m)** $\mathbf{F} = \mathbf{B} \times \mathbf{I} \times l$	**Specific Heat** Explain how heating a system will change the energy stored within the system and raise its temperature or produce changes of state Define the terms specific heat capacity and specific latent heat and explain the differences between them Use the equation: thermal energy for a change of state (J) = mass (kg) × specific latent heat (J/kg) $Q = m \times L$ Use the equation: change in thermal energy (J) = mass (kg) × specific heat capacity (J/kg °C) × change in temperature (°C)	**Resistance** Explain how changing the resistance in a circuit changes the current and how this can be achieved using a variable resistor Recall and use the equation: potential difference (volt, V) = current (ampere, A) × resistance (ohm, Ω) $V = I \times R$ Explain why, if two resistors are in series, the net resistance is increased, whereas with two in parallel the net resistance is decreased Calculate the currents, potential differences and resistances in series circuits

		Know that a beta particle is a high energy electron somehow emitted from the nucleus Its medium mass and charge make it medium ionising and penetrating. Show the radium source (α β and γ), block the others and show the penetration of gamma through lead. Know that a gamma ray is electromagnetic radiation. Compare alpha, beta and gamma radiations in terms of their abilities to penetrate and ionise.		$\Delta Q = m \times c \times \Delta\theta$	Explain the design and construction of series circuits for testing and measuring
Lesson 5 Learning intentions	**Power** Define power as the energy transferred per second. Recall and use the equation: power (watt, W) = work done (joule, J) ÷ time taken (second, s) $P = E/T$	**Background and contamination** Clarify the sources of background radiation seen in the demo the previous lesson or demo again with banana skin. Explain what is meant by background radiation including sources of background radiation (and	**Induced currents (making electricity)** **Recall that potential difference is another name for voltage and that a voltage in a circuit will make a current flow.** **Recall the factors that affect the size and direction of an induced potential difference. This is best done with sensitive**	**Specific Heat core practical** Core Practical: Investigate the properties of water by determining the specific heat capacity of water and obtaining a temperature-time graph for melting ice. Explain the use of thermal insulation to reduce the loss of thermal energy during the practical.	**More about resistance** Explain how current varies with potential difference for the following devices and how this relates to resistance a) filament lamps b) diodes c) fixed resistors Describe how the resistance of a light-dependent resistor

	If possible, work out your personal power as a practical.	why Keighley is relatively safe.) Describe methods for measuring and detecting radioactivity limited to photographic film and a Geiger–Müller tube. Describe the dangers of ionising radiation in terms of tissue damage and possible mutations and relate this to the precautions needed. Describe the differences between contamination and irradiation effects and compare the hazards associated with these two.	**analogue meters, coils and magnets as a class practical.** **Explain how an alternating current in one circuit can induce a current in another circuit in a transformer (best shown with 120/240 turn coils as a practical**		(LDR) varies with light intensity Describe how the resistance of a thermistor varies with change of temperature (negative temperature coefficient thermistors only) Explain how the design and use of circuits can be used to explore the variation of resistance in the following devices a) filament lamps b) diodes c) thermistors d) LDRs
Lesson 6 Learning intentions	**Objects affecting each other** Describe, with examples, how objects can interact a) at a distance without contact, linking these to the gravitational, electrostatic and magnetic fields involved b) by contact, including normal contact force and friction c) producing pairs of	**Decay Equations** Describe the process of β^- decay (a neutron becomes a proton plus an electron) Describe the process of β^+ decay (a proton becomes a neutron plus a positron) Explain the effects on the atomic (proton) number and mass (nucleon) number of radioactive decays (α, β, γ and neutron emission)	**National grid** **Recall that a transformer can change the size of an alternating voltage (note this is HT but you can't understand the next statement without it)** Explain why, in the national grid, electrical energy is transferred at high voltages from power stations, and then transferred at lower voltages in each locality for domestic uses as it	**Absolute zero** Explain the pressure of a gas in terms of the motion of its particles Explain the effect of changing the temperature of a gas on the velocity of its particles and hence on the pressure produced by a fixed mass of gas at constant volume (qualitative only) Describe the term absolute zero, −273 °C, in terms of the	**Core Practical** Core Practical: Construct electrical circuits to: a) investigate the relationship between potential difference, current and resistance for a resistor and a filament lamp b) test series and parallel circuits using resistors and filament lamps

	forces which can be represented as vectors Explain the difference between vector and scalar quantities using examples Explain ways of reducing unwanted energy transfer through lubrication	Use given data to balance nuclear equations in terms of mass and atomic number.	improves the efficiency by reducing heat loss in transmission lines Explain where and why step-up and step-down transformers are used in the transmission of electricity in the national grid	lack of movement of particles Convert between the kelvin and Celsius scales	
Lesson 7 Learning intentions	**Vector diagrams** **(H) Use vector diagrams to illustrate resolution of forces, a net force, and equilibrium situations (scale drawings only)** **(H) Draw and use free body force diagrams** **(H) Explain that several forces can ad together to make a resultant force on** **(h) Describe cases of balanced forces when the resultant force is zero**	**Half-Life** Describe how the activity of a radioactive source decreases over a period of time. Recall that the unit of activity of a radioactive isotope is the Becquerel, Bq. Explain that the half-life of a radioactive isotope is the time taken for half the undecayed nuclei to decay or the activity of a source to decay by half. Explain that it cannot be predicted when a particular nucleus will decay but half-life enables the activity of a very large number of nuclei to be	**National grid calculations** Use the power equation (for transformers with100% efficiency): potential difference across primary coil (volt, V) × current in primary coil (ampere, A) = potential difference across secondary coil (volt, V) × current in secondary coil (ampere, A) VP × IP =VS × IS		**Transferring energy** Recall that, when there is an electric current in a resistor, there is an energy transfer which heats the resistor Explain that electrical energy is dissipated as thermal energy in the surroundings when an electrical current does work against electrical resistance Explain the energy transfer (in 10.22 above) as the result of collisions between electrons and the ions in the lattice **(H) Explain ways of reducing unwanted energy transfer through low resistance wires**

		predicted during the decay process. Use the concept of half-life to carry out simple calculations on the decay of a radioactive isotope, including graphical representations Tillich blocks (dice) practical can illustrate this well			Describe the advantages and disadvantages of the heating effect of an electric current Use the equation: energy transferred (joule, J) = current (ampere, A) × potential difference (volt, V) × time (second, s) $E = I \times V \times t$
Lesson 8 Learning intentions					**Power** Describe power as the energy transferred per second and recall that it is measured in watts Recall and use the equation: power (watt, W) = energy transferred (joule, J) ÷ time taken (second, s) $P = E/t$ Explain how the power transfer in any circuit device is related to the potential difference across it and the current in it Recall and use the equations: electrical power (watt, W) = current (ampere,

					A) × potential difference (volt, V) $P = I \times V$ electrical power (watt, W) = current squared (ampere^2, A^2) × resistance (ohms, Ω) $P = I^2 \times R$
Lesson 9 Learning intentions					**Transferring energy by electricity** Describe how, in different domestic devices, energy is transferred from batteries and the a.c. mains to the energy of motors and heating devices Explain the difference between direct and alternating voltage Describe direct current (d.c.) as movement of charge in one direction only and recall that cells and batteries supply direct current (d.c.) Describe that in alternating current (a.c.) the movement of charge changes direction Recall that in the UK the domestic supply is a.c., at a

					frequency of 50 Hz and a voltage of about 230 V Describe, with examples, the relationship between the power ratings for domestic electrical appliances and the changes in stored energy when they are in use
Lesson 10 Learning intentions					**Electrical safety** Explain the difference in function between the live and the neutral mains input wires. Explain the function of an earth wire and of fuses or circuit breakers in ensuring safety. Explain why switches and fuses should be connected in the live wire of a domestic circuit. Recall the potential differences between the live, neutral and earth mains wires. Explain the dangers of providing any connection between the live wire and earth.